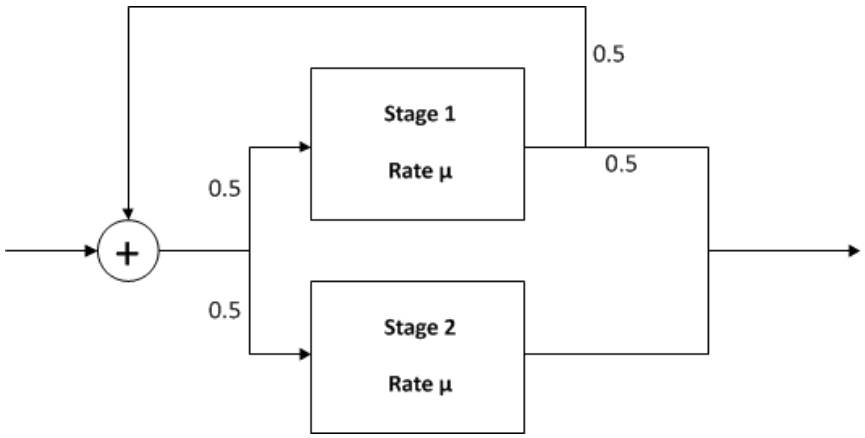
EEE33 Queueing Systems (2011-12)
Mid Term Examination

Maximum Marks: 30 **Time: 2 hours**

1. The two servers, A and B, in an M/M/2 system have the following service rule. After the system becomes empty, the first customer coming for service is served by the **server who was working most recently**. Assume that arrivals come to the system at rate λ and that server A and B work with rates μ_A and μ_B, respectively.

(a) Draw the State Transition Diagram of the system with a proper definition of the system state. **[5]**
(b) Use (a) to solve for the probability of finding j customers in the system for j=0,1,2…… **[5]**

2. Consider a M/G/1 queue where the service is given in stages as shown below. Each stage provides exponentially distributed service times with mean 1/μ.



(a) What is distribution (i.e. L.T. of the pdf) of the overall service time? **[2]**
(b) What is the mean service time and what is its second moment? **[2+2]**
(c) Draw the State Transition Diagram of the system. **[4]**

3. Consider an M/G/1 queue with vacations where only a **maximum of two vacation intervals** are allowed. The server goes for the first vacation whenever the queue becomes empty. If it finds the queue still empty when it gets back from the first vacation, it goes for the second vacation. Even if the queue is empty when it returns from the second vacation, it stays and waits for the next arrival to come. Using standard notation used in class, i.e. λ, b(x), B(x), $L_B(x)$, $\overline{X}$, $\overline{X^2}$, $f_V(x)$, $F_V(x)$, $L_V(x)$, $\overline{V}$, $\overline{V^2}$ etc., find the following.

(a) Mean Length of Idle Period in a cycle **[2]**
(b) Mean Length of Busy Period in a cycle and Probability of Server being Idle **[2]**
(c) Mean Residual Time (Service or Vacation) **[2]**
(d) Generating Function of the number in the system **[4]**